

What is claimed is:

1. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other,

wherein the first lens has a first surface and a second surface and the second lens has a third surface and a fourth surface as an optically functional surface, and wherein when the objective lens has an object side and an image side, the first surface, the second surface, the third surface and the

fourth surface are arranged in this order from the object side and the first surface and the third surface are a convex surface respectively, and

wherein an outer diameter of the second lens is smaller than that of the first lens.

2. The objective lens of claim 1, wherein the first contacting surface is provided on a flange section provided around the periphery of the second surface and is protruded toward the image side in the optical axis direction from a position of the second surface and the second contacting surface is provided on a flange section provided around the periphery of the third surface and is protruded toward the object side in the optical axis direction.

3. The objective lens of claim 2, wherein the first contacting section and the second contacting section are brought in contact with each other so that the first lens holds the second lens.

4. The objective lens of claim 1, wherein the fourth surface is a flat surface.

5. The objective lens of claim 1, wherein a concave portion made hollow toward the object side from a position where the fourth surface is located closest to the object is provided on the flange section provided around the periphery of the optically functional section.

6. The objective lens of claim 1, wherein the first contacting section and the second contacting section are brought in contact with each other so that relatively positioning in the optical axis direction between the first lens and the second lens is determined.

7. The objective lens of claim 6, wherein the first contacting surface has a first perpendicular surface perpendicular to the optical axis and the second contacting surface has a second perpendicular surface perpendicular to the optical axis and wherein the first perpendicular surface and the second perpendicular surface are brought in contact with each other so that relatively positioning in the optical axis direction between the first lens and the second lens is determined.

8. The objective lens of claim 1, wherein the first contacting section and the second contacting section are brought in contact with each other so that relatively positioning in a direction perpendicular to the optical axis between the first lens and the second lens is determined.

9. The objective lens of claim 8, wherein the first contacting surface has a first parallel surface parallel to the optical axis and the second contacting surface has a second parallel surface parallel to the optical axis and wherein the first parallel surface and the second parallel surface are brought in contact with each other so that relatively positioning in the direction perpendicular to the optical axis between the first lens and the second lens is determined.

10. The objective lens of claim 1, wherein the first contacting section and the second contacting section are brought in contact with each other so that relatively positioning in the optical direction and in a direction perpendicular to the optical axis between the first lens and the second lens is determined.

11. The objective lens of claim 10, wherein the first contacting surface has a first perpendicular surface perpendicular to the optical axis and a first parallel surface parallel to the optical axis and the second contacting surface has a second perpendicular surface perpendicular to the optical axis and a second parallel surface parallel to the optical axis and wherein the first perpendicular surface and the second perpendicular surface are brought in contact with each other so that relatively positioning in the optical axis direction between the first lens and the second lens is determined, and the first parallel surface and the second parallel surface are brought in contact with each other so that relatively positioning in the direction perpendicular to the optical axis between the first lens and the second lens is determined.

12. The objective lens of claim 1, wherein the first contacting section and the second contacting section are brought in contact with each other so that the first lens and the second lens are engaged tightly with each other with no clearance between the first lens and the second lens.

13. The objective lens of claim 1, wherein the first contacting section and the second contacting section are brought in contact with each other so that the first lens and the second lens are engaged with each other with a clearance between the first lens and the second lens.

14. The objective lens of claim 1, wherein after the first contacting section and the second contacting section are brought in contact with each other, the first lens and the second lens are fixed.

15. The objective lens of claim 1, wherein the optically functional section of the first lens and the optically functional section of the second lens are located opposite to each other and are spaced from each other.

16. The objective lens of claim 1, wherein the diameter of the optically functional section of a lens located closest to the image side is 40% or less of the outer diameter of the lens.

17. The objective lens of claim 1, wherein the first contacting section and the second contacting section are

provided in a ring-shaped form on the flange section around the optically functional section.

18. The objective lens of claim 1, wherein a first image side-flat surface is provided in a direction perpendicular to the optical axis at the image side on the flange section outer more than the first contacting section and a second image side-flat surface is provided in a direction perpendicular to the optical axis at the image side on the flange section outer more than the optically functional section of the second lens.

19. The objective lens of claim 18, wherein the first image side-flat surface and the second image side-flat surface are a mirror surface respectively.

20. The objective lens of claim 1, further comprising:  
a gas flow passage to allow gas to flow between a space enclosed by the optically functional section of the first lens and the optically functional section of the second lens and outside of the object lens.

21. The objective lens of claim 20, wherein the gas flow passage is provided in the vicinity of a position where the first lens and the second lens are jointed.

22. The objective lens of claim 20, wherein the gas flow passage is provided on one of the first lens and the second lens.

23. The objective lens of claim 1, wherein the flange section of the first lens and the flange section of the second lens are fitted with each other almost all around the flange section and predetermined portions on the fitted section between the flange section of the first lens and the flange section of the second lens are applied with an adhesive and a portion on the fitted section is not applied with the adhesive.

24. The objective lens of claim 1, wherein the flange section of the first lens and the flange section of the second lens are fitted in close contact with each other almost all around the flange section and at least one of the first lens and the second lens has a water vapor transmission ratio of  $1 \text{ g/m}^2 \cdot 24\text{h}$  to  $60 \text{ g/m}^2 \cdot 24\text{h}$ .

25. The objective lens of claim 1, wherein the flange section of the first lens and the flange section of the second lens are fitted in close contact with each other almost all around the flange section and at least one of the first lens and the second lens has the coefficient of the water absorption of the adhesive after hardened is 0.01% to 2%.

26. The objective lens of claim 1, wherein a numerical aperture of the objective lens is 0.8 to 0.9.

27. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the

optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other,

wherein the first lens has a first surface and a second surface and the second lens has a third surface and a fourth surface as an optically functional surface, and wherein when the objective lens has an object side and an image side, the first surface, the second surface, the third surface and the fourth surface are arranged in this order from the object side and the first surface and the third surface are a convex surface respectively, and wherein the fourth surface is a flat surface..

28. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other,

wherein the first lens has a first surface and a second surface and the second lens has a third surface and a fourth surface as an optically functional surface, and wherein when the objective lens has an object side and an image side, the first surface, the second surface, the third surface and the fourth surface are arranged in this order from the object side and the first surface and the third surface are a convex surface respectively, and

wherein a concave portion made hollow toward the object side from a position where the fourth surface is located closest to the object is provided on the flange section provided around the periphery of the optically functional section.

29. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the first contacting surface has a first parallel surface parallel to the optical axis and the second contacting surface has a second parallel surface parallel to the optical axis and wherein the first parallel surface and the second parallel surface are brought in contact with each other so that relatively positioning in the direction

perpendicular to the optical axis between the first lens and the second lens is determined.

30. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the first contacting surface has a first perpendicular surface perpendicular to the optical axis and a first parallel surface parallel to the optical axis and the second contacting surface has a second perpendicular surface

perpendicular to the optical axis and a second parallel surface parallel to the optical axis and wherein the first perpendicular surface and the second perpendicular surface are brought in contact with each other so that relatively positioning in the optical axis direction between the first lens and the second lens is determined, and the first parallel surface and the second parallel surface are brought in contact with each other so that relatively positioning in the direction perpendicular to the optical axis between the first lens and the second lens is determined.

31. An objective lens for use in an optical pickup apparatus, comprising:

- a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

- a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the diameter of the optically functional section of a lens located closest to the image side is 40% or less of the outer diameter of the lens.

32. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the

second contacting section are brought in contact with each other, and

wherein a first image side-flat surface is provided in a direction perpendicular to the optical axis at the image side on the flange section outer more than the first contacting section and a second image side-flat surface is provided in a direction perpendicular to the optical axis at the image side on the flange section outer more than the optically functional section of the second lens.

33. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the first contacting section has a first slope surface slanted to the optical axis and the second contacting section has a second slope surface slanted to the optical axis and wherein the first slope surface and the second slope surface are brought in contact with each other so that relatively positioning in the optical axis direction and in the direction perpendicular to the optical axis between the first lens and the second lens is determined.

34. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the

optically functional section, and a second contacting section provided on the flange section, wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

a gas flow passage to allow gas to flow between a space enclosed by the optically functional section of the first lens and the optically functional section of the second lens and outside of the object lens.

35. The objective lens of claim 34, wherein the portion not applied with the adhesive is used as a gas flow passage.

36. The objective lens of claim 34, wherein the portion not applied with the adhesive is provided at least two positions on the fitted section.

37. The objective lens of claim 34, wherein the predetermine portions applied with the adhesive are arranged with an equal interval between the predetermine portions.

38. The objective lens of claim 34, wherein the water vapor transmission ratio of the adhesive after hardened is  $10 \text{ g/m}^2 \cdot 24\text{h}$  to  $60 \text{ g/m}^2 \cdot 24\text{h}$ .

39. The objective lens of claim 34, wherein a coefficient of water absorption of the adhesive after hardened is 0.1% to 10%.

40. The objective lens of claim 34, wherein the adhesion strength of the adhesive after hardened is  $40 \text{ Kg/cm}^2$  to  $300 \text{ Kg/cm}^2$ .

41. The objective lens of claim 34, wherein at least one of the first lens and the second lens has a water vapor transmission ratio of  $1 \text{ g/m}^2 \cdot 24\text{h}$  to  $60 \text{ g/m}^2 \cdot 24\text{h}$ .

42. The objective lens of claim 34, wherein at least one of the first lens and the second lens has the coefficient of the water absorption of the adhesive after hardened is 0.01% to 2%.

43. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the flange section of the first lens and the flange section of the second lens are fitted with each other almost all around the flange section and predetermined portions on the fitted section between the flange section of the first lens and the flange section of the second lens are applied with an adhesive and a portion on the fitted section is not applied with the adhesive.

44. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the flange section of the first lens and the flange section of the second lens are fitted in close contact with each other almost all around the flange section and at least one of the first lens and the second lens has a water vapor transmission ratio of  $1 \text{ g/m}^2 \cdot 24\text{h}$  to  $60 \text{ g/m}^2 \cdot 24\text{h}$ .

45. An objective lens for use in an optical pickup apparatus, comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein the flange section of the first lens and the flange section of the second lens are fitted in close contact with each other almost all around the flange section and at least one of the first lens and the second lens has the coefficient of the water absorption of the adhesive after hardened is 0.01% to 2%.

46. An objective lens for use in a optical pickup apparatus, comprising:

- a first lens having an optically functional section;
- a second lens having an optically functional section;
- an intermediate holding member to hold the first lens and the second lens in such a way that the first lens, the second lens and the intermediate holding member are constructed in a single body, and

- a gas flow passage to allow gas to flow between a space enclosed by the optically functional section of the first lens, the intermediate holding member and the optically functional section of the second lens and outside of the object lens.

47. The objective lens of claim 46, wherein the gas flow passage is provided in the vicinity of a position where the first lens, the intermediate holding member and the second lens are jointed.

48. The objective lens of claim 46, wherein the gas flow passage is provided on at least one of the first lens, the intermediate holding member and the second lens.

49. An optical unit for use in an optical device, comprising:

a first optical element having an optically functional section and a first contacting section provided on a periphery of the optically functional section, and

a second optical element having an optically functional section and a first contacting section provided on a periphery of the optically functional section;

wherein the first optical element and the second optical element are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other and an enclosure space is provided between the first optical element and the second optical element, and

wherein at least one of the first optical element and the second optical element is provided with an air flow passage to communicate between the enclosure space and the outside.

50. The optical unit of claim 49, wherein the first optical element is a flat plate-shaped optical element and the second

optical element is a lens having a flange section provided around the optically functional section, and wherein the second contacting section is provided on the flange section and is fixed with the first contacting section with an adhesive.

51. The optical unit of claim 50, wherein the flat plate-shaped optical element is a hologram element, a wavelength plate, a polarizing plate and a phase correcting element.

52. An optical pickup apparatus, comprising:

an objective lens comprising:

a first lens molded with a plastic and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a first contacting section provided on the flange section; and

a second lens molded with a plastic, located opposite to the first lens and having an optically functional section, a flange section provided around the periphery of the optically functional section, and a second contacting section provided on the flange section,

wherein the first lens and the second lens are jointed in such a way that the first contacting section and the second contacting section are brought in contact with each other, and

wherein on the condition where the first contacting section and the second contacting section are brought in contact with each other so that relatively positioning in the optical axis direction between the first lens and the second lens is determined, when the second lens is shifted relatively to the first lens in a direction perpendicular to the optical axis in a clearance on a fitted section between the first lens and the second lens, a variance in wave front aberration on an image forming point is less than a value defined by a diffraction limiting function.

53. The optical pickup apparatus of claim 52, wherein optical pickup apparatus has a wave front aberration lower than the value defined by Maréchal's criterion.

54. The optical pickup apparatus of claim 52, wherein the first lens is held by a lens frame driven by an actuator.